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TECHNOLOGICAL LEAP-FROGGING IN THE CONGO BASIN, PYGMIES AND GLOBAL POSITIONING SYSTEMS IN CENTRAL AFRICA: WHAT HAS HAPPENED AND WHERE IS IT GOING?

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ABSTRACT It is surprising that many Pygmy hunter-gatherers in the Congo Basin, though unable to read the numbers on banknotes or write their own names, have begun to use handheld computers attached to global positioning systems (GPS). In describing this remarkable case of technological leap-frogging I will summarise the historical context that led to this situation, followed by a survey of the different uses that Pygmies are putting the GPS to in Cameroon, Republic of Congo, Central African Republic, Democratic Republic of Congo and Gabon. What are the reasons for this sudden technological engagement and what has it made possible?

Key Words: GPS; Mapping; Logging; Conservation; Technology.

INTRODUCTION[1]

Changes during the last few years have lead to the GPS becoming an important tool that some Pygmy groups across the Congo Basin have started to use to support their claims for recognition and rights[2]. The GPS is of course ambivalent, and is used both to support local forest peoples' rights and to undermine their rights. When it was a relatively new technology it was mostly used in ways that served to disenfranchise forest people (Lewis, forthcoming).

With the development of GPS units with receivers sufficiently efficient to work under the forest canopy in the late 1990s non-forest people, government officials and outsiders such as loggers or conservationists could find their way in and out of forest areas without getting lost and without depending on local forest people to guide them. This has undermined the traditional control Pygmy groups had over strangers entering their forest and resulted in many remote forest areas which Pygmies once controlled becoming known to a wide range of outsiders.

In conjunction with these advances, great progress in geographic information system software (GIS) has facilitated urban, office-based, yet fine-grained land management decision-making. Supported by these technologies non-forest people present the forest in ways that privilege their own interests: governments as providing development, employment and tax generating opportunities, loggers as containing rich sources of high value timber, and conservationists as biodiverse environments deserving protection from people. Miners have now begun to join these other outsiders and are successfully negotiating rights to cut down huge areas of forest in search of valuable minerals.

In promoting their particular interests each uses maps to present their vision of value in the forest. These presentations of value are selective and do not acknowledge the presence of Pygmies[3]. As a consequence decisions are taken that have had profoundly negative consequences on Pygmies as they are steadily disenfranchised of land and access to key resources. Their forest occupation, management practices, key resources and livelihood needs have been ignored, at least until very recently.

THE HISTORICAL CONTEXT LEADING PYGMIES TO USE GPS UNITS

A conjunction of structural adjustment programmes, pressures to introduce more democratic and transparent government and the desire to achieve the Millennium Development Goals in the early 1990s created the conditions for a massive expansion in forestry in the Congo Basin. Structural adjustment programmes led to unpopular staff reductions in the civil service, which had been the main employer in many Congo Basin countries and a key aspect of the patronage systems that supported members of the political elites. With the introduction of more democracy in government and transparency in financial affairs, political elites began to think more carefully about how to ensure their popularity. Under pressure from international financial and development organisations they were encouraged to promote opportunities for private sector investment in their countries.

Despite a growing international consensus on the importance of the Congo Basin forests and the biodiversity they contain for mitigating the effects of climate change, a key target for expansion was the relatively under-developed forestry sector in the Congo Basin. The assumption was that by ensuring more logging companies were active in forested regions, jobs would be created in rural areas, tax income would increase to central government and thus improve their ability to provide basic services such as schools and health care to rural communities. With strong encouragement, financial and technical assistance from international donors and the World Bank, the process of establishing and demarcating new concessions in previously unexploited forest areas and then renting out the logging rights to the highest bidder began in Republic of Congo (RC) and Cameroon in the early 1990s. Around 2000 a second round of new concession demarcation occurred, this time also including Gabon, Democratic Republic of Congo (DRC) and to a lesser extent Central African Republic (CAR).

This process was concurrent with legal reform of the forestry sector in Cameroon in 1994, in RC in 2000, in Gabon in 2001, and in DRC in 2002. This was done in such a manner as to encourage international investment and more efficient central management of what were now perceived by national and international elites as national resources to be controlled and disposed of by central government regardless of local forest peoples' own conceptions of these areas as their ancestral or customary land.

International conservationists, animal protectionists and other NGOs were

quick to attack this expansion as a threat to the one of the world's key environments. In response, international donors and the World Bank pressurized governments into combining the establishment of the new logging concessions with the creation of Protected Areas in neighbouring forested regions.

Protected areas thus came to serve the interests of logging as well as those of big international conservation organisations, and expanded roughly simultaneously. The first major push to create protected areas took place in the early 1990s and then another in the late 1990s and early 2000s. While this dual approach may seem logical, it has disenfranchised forest peoples of land and resources, and resulted in serious damage to both biodiversity and Congo Basin ecosystems. By opening huge relatively undisturbed forest areas to industrial and commercial activities on an unprecedented scale, large areas have been condemned to become impoverished woodland surrounding tiny islands of protected resources in what were formerly key areas of major biodiversity (Lewis, 2008b). This is not a sensible strategy for the long-term conservation of the Congo Basin.

By ignoring forest peoples' land rights and resource needs, state institutions and national elites have been able to auction off resources that forest peoples' livelihoods depend on to multinational industrial corporations and big international conservation organizations. Once having obtained state authorization these powerful organizations use national forces of law and order to impose their agenda, violently if necessary, on forest areas which the hunter-gatherers, fishing or farming groups had always considered their own. Most farming and fishing groups in the region have some members living or working in towns who can represent them to government bodies, or are already in government positions. However the situation for the mostly non-literate hunter-gatherers is quite different. Both national governments and their neighbours consider the hunting and gathering way of life as primitive and for many it is shameful to the nation that hunter-gatherers continue to practice this lifestyle. This perception of hunter-gatherers is so common throughout the world that Marshall Sahlins coined the term 'neolithic prejudice' to describe it (Sahlins, 1972).

DISCRIMINATION AGAINST HUNTER-GATHERERS

Discrimination against hunter-gatherers is widespread (Woodburn, 1997) and this certainly underlies the casualness with which governments and other outsiders have appropriated Pygmy peoples' lands. The long-standing and widespread perception by local, national and international non-hunter-gatherers that hunting and gathering does not confer rights over land, and that the land used by hunter-gatherers is not properly utilized, lies at the heart of the problems that have led to Pygmies using GPS machines. As more and more outsiders take over the management of their traditional forest areas and ignore or deny their needs, they have become obliged to make their presence known by showing how they use the forest.

This neglect of Pygmies is reinforced by the cartographic traditions of the

developed world. Maps were first used as objects to facilitate exploration and conquest, but then became tools of administration and control as colonial regimes installed themselves. Maps emphasise geographic features and accessibility. So maps of Pygmy forests, such as the excellent 1:200,000 made by the French Insitut de Geographie National in the 1950s and 1960s, are now the basis for most modern maps of the region. They were made using aerial photography and so only show water networks, whether forest is on firm land, marsh or semi-flooded, and clearings such as farmers' fields, villages and towns. This was the key information required by the colonial authorities on which to base their administration.

The integrated sustainable use of forest made by Pygmies is invisible on these traditional maps because it leaves no enduring trace. While their invisibility was an advantage during the colonial period—since Pygmies rarely suffered the exactions imposed on farmer communities—today it is resulting in their interests not being taken into account in important land management decisions.

THE CASE OF CAMEROON FOREST ZONING

In 1993, the Cameroonian Department of Forests hired the services of a Canadian consultancy firm (Tecsult Inc.) to prepare a *plan de zonage* for southern Cameroon using the base maps created during the colonial period with the addition of more recent satellite and aerial images. Based on information gathered from the interpretation of the satellite imagery and aerial photographs they established maps showing areas of human occupation and cultivation, forest types and ecological zones, accessibility, soil types, agricultural usage, timber resources, and with some additional information also on other resources such as minerals. By superimposing these different data sets, the plan de zonage was drawn up, at a scale of 1:200,000 (Pénelon et al., 1998).

Although the plan made for Cameroon's forest zoning by Tecsult was intended to be provisional—to be adopted only after extensive consultation, checking and consequent adjustment—this did not happen. The dependence on satellite imagery, the heavy bias towards the interests of commercial logging and the state, the absence of any effective process of consultation to incorporate forest peoples' rights and interests in an accurate and workable manner resulted in the different needs of forest communities not being taken into account (Hoare, 2006).

In what was heralded as a model of reformed forestry law in the 1990s, the Cameroonian government used the zoning by Tecsult to divided the forest into zones for use by the population along roadsides, called the Non-Permanent Forest Estate (NPFE), and other much larger and more remote zones called the Permanent Forest Estate (PFE), attributed to the state where local peoples' activities were forbidden and industrial logging and mining would be encouraged. While zoning along the roadsides addressed the needs of local agriculturalist communities, the zoning of the PFE encompassed the majority of forest areas used by Pygmy groups such as the Baka and the Bagyeli. In effect,

without their knowledge or consent, their forest land was alienated from them (Hoare, 2006).

Included in the NPFE are 5,000 hectare areas for agriculture, for community forestry and hunting territories. Communities can apply for community forests of up to 5,000 hectares, under 25 year leases, to be reviewed every 5 years. They need to prepare a simplified management plan and create specific structures to administer the community forest during the lease. This all requires reasonable education, management and financial skills to administer correctly. Hunting territories, of up to 5000 hectares can also be established within the NPFE (Lescuyer, 2003).

This modern-day example of Neolithic prejudice sought to include all stakeholders apart from hunter-gatherers in forest zoning. Indeed, most of the land that was placed in the government controlled PFE zones is traditional Baka forest. Without consultation, reparation or any warning Baka lost access to the majority of their land. The government's formalisaton of its alienation of Baka land was completed only when it succeeded in renting it out to loggers, conservationists, miners or safari hunters, who would then enforce the exclusion of the Baka. This has now been achieved in a systematic way across south-east Cameroon, leading to Baka becoming painfully aware of their sudden marginalisation from their land and wild resources. The poorest sector of Cameroon's population has had its resource base appropriated by the richest, for the benefit of national and international elites.

The zoning problems do not stop there. While the standard 5,000 hectare zones allocated to each village for their agricultural needs, community forestry and hunting and fishing needs were unlikely to satisfy even the requirements of settled agriculturalists (Hoare, 2007: 11), they are hopelessly inadequate for the needs of hunter-gatherers. In 1996 in northern RC I mapped local Mbendjele hunter-gatherer territories and found that they ranged between 150,000 hectares and 550,000 hectares (Lewis, 2002: 72; Hoare, 2007: 21). In effect allocating only 5,000 hectares for hunting and gathering will lead to these zones rapidly suffering from over-exploitation. In the long term, this could potentially be used to justify hunter-gatherers being further disenfranchised as has happened to the Twa Pygmies of south-western Uganda and Rwanda (Lewis, 2000: 19–21).

Anyone who has spent time with Baka in south-eastern Cameroon will know how resentful they are about the consequences of this forest zoning on their access to hunted and gathered resources and traditional forest areas. Baka I know often talk about this as colonisation of their lands and the denial of their right to hunt and gather. Baka living near Moloundou, for instance, suddenly found their favourite hunting and gathering forest areas attributed to aggressive safari hunting organisations catering to wealthy international tourists who violently intimidate Baka and deny them access to key resources for their livelihoods. Through this zoning what once sustained the poorest rural Cameroonians is now a resource for the world's elite super-rich. Other groups, living nearer to National Parks are similarly upset about conservationists such as WWF (named *dobédobé* by the Baka) and the violent behaviour of 'eco-guards' burning down camps, harassing and beating both men and women for what the

Baka consider absolutely normal, traditional and legitimate activities.

While conservation and wildlife laws provide for local communities to exercise 'traditional' livelihoods, in practice Baka subsistence hunting and gathering is treated as illegal by law-enforcers influenced by Euro-American conservation discourse responding to industrial development. Through intimidation and violence outsiders are gaining control over the forests that the Baka depend on, resulting in increased food insecurity, illness and poverty. This is a broader pattern affecting many Pygmy hunter-gatherer groups throughout the Congo Basin, wherever the expansion of logging and conservation proceed together.

FORESTERS AND CONSERVATIONISTS

Mbendjele Pygmies with whom I work in northern RC in the mid-1990s did not differentiate between loggers and conservationists. While this may seem surprising to outsiders who often see the two groups as opposing each other, the Mbendjele perspective is probably closer to reality. In Lewis (2008b) I discuss the reasons for this conflation in detail, in particular linking it to the way that both actors tend to use the other to legitimate their activities: loggers point to the efforts made to establish conservation areas as legitimating the expansion of their activities, while conservationists justify the imposition of protected areas on local people's land with reference to logging and its consequences.

Traditional Mbendjele forest management focuses on ensuring the proper sharing of whatever is taken out of the forest as the key way to ensure that forest resources remain abundant (Lewis, 2008a; 2008b). Mbendjele notice that since these new forest management regimes have been imposed on their forest areas resources are diminishing. Loggers hoard valuable trees for themselves and do not share the proceeds equitably. Similarly, conservationists hoard some of the best forest areas for themselves and deny people the right to hunt many of the animals that are nutritionally and culturally important to them.

In other parts of the Congo Basin conservationists' response to the problems created by the expansion of logging roads and their use to supply the increased urban demand for wild meat have led to very similar results for the Pygmy groups occupying these areas (Lewis & Nelson, 2006). As logging roads spread out to open up previously inaccessible forest areas, outsiders come in and extract valuable resources in huge amounts without Pygmy consent, guidance or assistance. Suddenly resources that Pygmies thought they managed—such as the wild animals—became accessible to all. In areas recently opened up by roads commercial hunting predictably became an increasingly serious problem. In response, conservationists set-up paramilitary patrols called 'eco-guards' with the intention of catching 'poachers.' While this has proved effective in certain contexts, notably when control is focused on road blocks that enable passing vehicles to be searched, other aspects of eco-guards' activities have become a serious problem for many Pygmies.

The distinction between a Pygmy hunter and a poacher is often ignored and

eco-guards frequently make them scapegoats in their anti-poaching controls. Since local political and military elites organize the most intensive commercial poaching and most significant environmental crimes, eco-guards are often unable to arrest perpetrators due to their political connections. In this context, Pygmies become soft-targets in their forest camps for violent visitations. The beatings and other abuses experienced during these visits are a source of great anger among groups such as the Mbendjele in northern RC (Lewis, 2008b; N'zobo et al., 2004), Batwa in Rwanda, Uganda and DRC, Mbuti in the Ituri, and Baka in south-eastern Cameroon (Nelson & Hossack, 2003).

While formal presentations of conservation areas by international donors, national political elites and conservation organisations present protected areas as securing the future for local peoples' resource base, and employ the language of participatory management, capacity building and benefit sharing to describe conservation's relationships with local people, the reality is quite different. Most conservation areas in forested parts of Cameroon, CAR and RC, for instance, have actually appropriated Pygmy peoples' land in order to create the national parks. Local Pygmies have experienced this as imposition without consultation, of exclusion from their most valued forest areas, and of violent intimidation and gross injustices when people carry out activities they consider to be their birth-right. This is not a historical problem, as some conservationists claim, but a contemporary one.

Despite positive rhetoric and even signing up to commitments such as the Durban Accord and Action Plan[4] agreed at the Fifth International Union for Conservation of Nature (IUCN) World Parks Congress on Protected Areas in 2003, which states as one of its objectives to secure 'the rights of indigenous peoples, including mobile indigenous peoples, and local communities … in relation to natural resources and biodiversity conservation.' Yet organisations such as WWF do not implement these accords in their field practice in conservation areas. For instance, the Boumba Bek National Park and the adjoining Nki National Park in the southeast of Cameroon were created by governmental decree in 2005 without consulting indigenous communities and given to WWF to administer. Baka Pygmies living in the area were suddenly denied access to large forest areas that they traditionally occupied and used. WWF established Eco-guard patrols to search out illegal poaching inside the parks. According to Forest Peoples Project (2006: 7):

> The guards' activities have resulted in a series of human rights abuses against Baka including the complete destruction of camps, villages and other possessions such as cooking pots and identity cards and confiscation of tools including machetes, axes and spears. There are also serious allegations of violence by guards against local Baka men and women, which after investigation by the bodies involved led to sanctions against individual guards, and a overall renewal of guard staff in southeast Cameroon during 2006.

Paramilitary eco-guard groups are now a standard part of the package that conservation organisations employ to manage protected areas and their

surroundings despite these well-publicised excesses and a growing awareness of their manipulation by political elites and commercial interests in conducting highly damaging commercial hunting activities. Even though most field conservation workers are well aware of these issues they rarely enter their reports or appraisals of work in their project area.

The consequences of ignoring the problems that this method of 'conserving' Congo Basin forests has produced are glossed over or denied by most conservation leaders working in the region. However, local people are very well aware of the damage these regimes are doing to the ecosystems they depend upon. Lambombo, a Baka elder (*kobo*) from the village of Miatta next to the Dja Reserve explained it to me in the following way:

> Before this was all our forest, our ancestors were all hunters who lived in the forest. Our fathers told us to live in this forest and to use what we needed. Komba (God) made the forest for all of us, but first of all for the Baka. When we see the forest we think that is our forest'. But now we are told by the government and the conservationists that it is not our forest. But we are hunters and need the forest for our lives.
>
> Of these others who say our forest is theirs there is Ecofac (the conservationists), MINEF (the ministry for forests) and the loggers. When the loggers cut our trees we got nothing, and we still get nothing. We who are older notice that all that was in the forest before is getting less. We used to always find things—yams, pigs and many other things—we thought that would never end. Now when we try and look we can't find them anymore.
>
> The government and the conservationists have messed up our forest. When we looked after the forest there was always plenty. Now that we are forbidden to enter our forest when we put out traps they remain empty. Before, if we put out traps and nothing walked on them we would take them elsewhere to let the forest rest. We know how to look after the forest.
>
> Instead, now we are persecuted by Ecofac. They take anything we hunt from us, even small animals from behind our houses. The Eco-guards are terrible. They even take our crops from our forest camps and harass us for any game. For instance if the Eco-guards were to see one of us walking out of the forest from our farm with a basketful of bananas or manioc, and maybe a small duiker resting on top, they will stop us and confiscate everything, including the freshly harvested crops. They just take it home for their supper. All we can do is say 'Hey Komba (God), they just took everything!'
>
> (Lambombo Etienne, Miatta village, November 2002)

So while forestry and other industrial activities were promoted by powerful outsiders as a means to develop these remote areas and contribute to poverty alleviation, the results could not have been more different for most Pygmies. Often finding themselves alienated from their best forest areas, unable to compete for desirable work in the logging industry as outsiders with existing skills claim the best jobs, and mostly in conflict with the conservationists' exclusionary and draconian management practices that arose in reaction to

logging and the activities its infrastructure facilitates, most Pygmies have found themselves losing out to both new-comers in recent decades.

This situation of marginalization experienced by many Pygmies is having serious consequences on many groups. Among the Mbendjele groups I know best I have noticed increasingly poor nutrition, increasing mortality, the emergence of conflict-prone 'supercamps' during much of the year instead of only briefly forming during the dry season for ceremonies, greater sedentarisation, and diminishing access to forest resources either through their removal by loggers and poachers for commercial reasons, or their protection by conservationists in response.

It is in this situation of escalating pressure on their hunter-gathering lifestyle from industrial activities and conservation, of marginalization from management decisions affecting their livelihoods, and from diminishing control over the areas of forest and the resources on which they depend, that the GPS has come to play a central role in supporting Pygmies to make their voices and opinions heard. Pygmies are using the GPS to collect accurate geo-referenced data on the resources that they use in their traditional forest areas. The maps then become their emissaries, able to communicate their most pressing concerns to powerful outsiders in office-based meetings to which Pygmies would never normally be invited.

Indeed maps have proved far more effective than more traditional advocacy methods based on meetings, workshops and research papers in promoting change in the practices of ecosystem mangers. The maps have been able to show in a concise and precise way the hunter-gatherers' forest use and spiritual values in a format that is easier to incorporate in high level management planning than expert reports or long discussions based in offices. Although still in their infancy, and as they become available to increasing numbers of forest people such solutions will develop and encompass ever greater areas of forest.

WHEN DID IT BEGIN? THE CHAD-CAMEROONIAN PIPELINE[(5)]

The conjunction of the mass marketing of affordable handheld GPS units in the early 2000s with the heavy-handed promotion and implementation of the Chad-Cameroon pipeline project provided the defining moment that demonstrated the value of supporting Pygmies to use GPS units to make geo-referenced maps of their resources and territories as an effective advocacy tool.

In 1999 it was clear to Cameroonian civil society organisations such as Planet Survey and the Centre for Environment and Development (CED) that the World Bank-funded Chad-Cameroon oil pipeline project that passed through Bagyeli Pygmies' forest in western Cameroon had failed to consult the Bagyeli properly in preparing the Indigenous Peoples Plan. This plan was meant to ensure appropriate measures were taken to protect indigenous peoples' rights and resources and was a condition of World Bank funding for the pipeline project.

While many farmers had been consulted, Pygmies had almost been ignored. The result was that local farming communities received almost all of the

compensation for damages caused during the construction of the oil pipeline, even though in many cases the lands were claimed and used by Bagyeli for hunting, gathering or agriculture. The attractiveness of compensation payments even led some farmers to chase Bagyeli communities from their lands in order to claim the compensation that should have been due to the Bagyeli. In these and other ways the pipeline project served to deny the Bagyeli's access to land and their rights to resources throughout the Lolodorf-Bipindi-Kribi corridor, especially around Bipindi where the project's activities were concentrated.

To offset the environmental damage caused by the pipeline the project established the Campo-Ma'an National Park outside the pipeline zone. But this made the situation of the Bagyeli worse, as the Park overlaps traditional Bagyeli hunting and gathering lands. The enforcement of hunting restrictions and violent anti-poaching patrols that targeted Bagyeli camps resulted in them losing access to significant areas of forest.

Recognition of these problems led to the establishment in 1999 of a partnership between Bagyeli communities, the UK-based NGOs Rainforest Foundation and Forest Peoples Programme (FPP), and the Cameroonian NGOs Planet Survey and the Centre for the Environment and Development (CED). The project aimed to combine on-going community consultations, community land use mapping, and the creation with local authorities of a platform for dialogue between all local stakeholders in order to address these problems.

Early efforts by Planet Survey to support the Bagyeli used participatory rural appraisal mapping techniques (facilitating communities to draw a sketch map of their land and resources) to provide evidence of how the Bagyeli had been ignored in land compensation payments. However, the informal look and lack of precision of these sketch maps seem not to have been persuasive enough to effect change in the way that the authorities conducted the pipeline project, and in their approach to Bagyeli people and their claims.

In 2003 things changed with commercial mass-production of accurate but affordable GPS units. A three year project by FPP, CED and Planet Survey developed a programme for the Bagyeli to accurately map their lands and resources. With training in GPS data collection and map representation for Bagyeli participants, and technical and logistical support from CED and Planet Survey, the Bagyeli rapidly produced maps to support them in negotiations with local government authorities and Bantu communities about Bagyeli land rights in the pipeline zone and their land-use in the Campo-Ma'an National Park.

The maps Bagyeli produced became the basis for their land claims in the multi-stakeholder Bipindi Land Forum, set up in 2004 and facilitated by Planet Survey. As a result of the mapping work and the Land Forum discussions, 14 Bagyeli communities from the Bipindi area obtained some legal recognition of their land rights, based on completion of a procès verbal. Another achievement of the maps was to help negotiate local agreements over land boundaries between communities, some of whom claimed Bagyeli areas. This important process has resulted in securing equitable land tenure agreements between all parties.

FPP and CED continued to facilitate dialogue between Bagyeli communities

and government authorities responsible for the Campo Ma'an National Park in the south-west of the country. Maps of forest use created by the communities clearly demonstrated the overlap between the park and the Bagyeli's traditional subsistence areas. However it was not until late 2006 that, based on these maps, the Bagyeli secured formal approval from the government for the protection of their access and use rights within the National Park. Under previous management plans the Bagyeli were banned from the park. While this was a ground-breaking decision by the government it has been difficult to legalise since it runs contrary to Cameroon national laws governing parks and therefore required special approval.

This was obtained, and Bagyeli rights of access and use of resources in the park are now part of the park's management plan. However heavy-handed enforcement of wildlife protection, needed to protect biodiversity as well as community livelihoods, threatens Bagyeli access and use in the park. Illegal hunters supplying a large worker population at a near-by rubber plantation (Hevecam) sometimes involve individual Bagyeli trackers and hunters in their activities. This has resulted in conservationists branding all Bagyeli as potential poachers and makes enforcement of the new provisions protecting community access in the Campo Ma'an National Park problematic.

THE FOREST PEOPLES' PROGRAMME'S APPROACH TO MAPPING: AN ISSUE-BASED STRATEGY[6]

FPP works with indigenous peoples in many countries around the world. Over the past 15 years they realised how effective community-based mapping can be as a tool for securing indigenous peoples' rights to land and resources and as a means to protect and manage biodiversity. This has lead to FPP evolving a strategy of transferring mapping skills to indigenous field teams and supporting them to document how their community uses different parts of the forest and their customary laws and institutions involved in resource management.

The experience of supporting the Bagyeli defined the approach that FPP would take to this work in Central Africa. Following on from their 'Parks and People' project (Nelson & Hossack, 2003), FPP began to systematically use mapping as a means to challenge the claims of conservationists that there was no human use of the forest areas now incorporated into national parks. When Park managers prevent hunter-gatherers from entering their customary areas they severely reduce the hunter-gatherers' ability to obtain food, with serious consequences on their health, culture and traditional knowledge.

Working with CED as their local partner, FPP supported communities to select their own teams to collect information after extensive community consultations, and use GPS and GIS systems to pinpoint and then map resource use. As icon-based GPS units became available from work in the logging industry (see later section), FPP was quick to incorporate this more accessible technology into its work with indigenous peoples and conservation organisations. Using this new technology maps are generated automatically and instantly as the

data is downloaded to a laptop in the field, so the community can immediately assess the outcome of their work and plan improvements. Once the whole community has validated the map a formal version is printed and left with the community.

Communities are then supported by local NGOs to use these maps and data to assert their rights through dialogue and negotiations with governments, conservation agencies and companies involved in logging, mining and plantations, who want access to land traditionally used and inhabited by the community. Such dialogues enable participants to discuss resource conflicts in a balanced and informed way and develop new approaches to resource management, with indigenous peoples and local communities playing a key role. This approach has been successfully used in South America and Asia, as well as Africa.

FPP have found that this mapping and advocacy approach is enjoyed by indigenous communities who find it an empowering experience. They report that it encourages mutual respect between younger and elder generations as they use the new technologies to map their resources. Indeed the process can reinvigorate traditional knowledge and, in conjunction with subsequent dialogues, help to strengthen the communities' commitment to sustainably manage their lands and resources' and defend them from external encroachment.

Applying this model in Central Africa, FPP has supported community consultation and documentation, provided training and key information, facilitated and trained community mappers from hunter-gatherer communities around Campo Ma'an National Park, Boumba Bek National Park, Nki National Park (Cameroon), Noubale-Ndoki National Park (RC), Minkébé National Park (Gabon), Dzanga Sangha Dense Forest Special Reserve (CAR) and Mgahinga National Park, Bwindi National Park and the Echuya Forest (Uganda).

With local civil society partners FPP trained local Pygmy communities affected by these National Parks to document their forest use in and around the park. After validation by the communities, the maps that they had made were presented to government forest authorities and park managers. During these meetings community representatives, conservation NGOs and government park managers reviewed the findings from the community-based studies, and the implications, both for community livelihoods and the conservation objectives of the park (Venant, 2009).

By 2009, for instance, Baka communities in south-eastern Cameroon had completed mapping their traditional use of Boumba Bek and Nki national parks. The maps show that almost the entire area of both parks—more than 600,000 hectares—comprises Baka customary lands. In particular, the large overlaps between Baka traditional forests and key areas used by chimpanzees and gorillas were used to argue that Baka forest management is sustainable and conserves these endangered species.

The Baka, assisted by FPP and their partners, were able to show that Baka customary use is sustainable and compatible with conservation, and that the main threat to biodiversity is the erosion of traditional practices, top-down planning and commercial bushmeat exploitation by outsiders. The restrictions

on Baka access to forest resources was jeopardising the sustainability of their livelihoods. This evidence and the discussions that followed led park managers to explore ways of addressing Baka use rights in the park management plans. Based on this information the Baka have obtained the World Wildlife Fund's commitment to protect community rights in management plans for the parks. The Cameroon government is also engaged in the process.

The outcome of this dialogue was the development of a plan of action, which includes at its core an agreement between communities, NGOs and government agencies working in and around Boumba-Bek and Nki National Parks to work together to secure legal protection for Baka ancestral territorial rights—both inside and outside the park. These protections will be sought in the park management plans, which are still under development, and also through changes to national laws and regulations governing conservation and forest management.

FPP and CED are now supporting similar dialogues between hunter-gatherer communities and conservation managers to pilot the integration of community rights in protected area management plans in the Dja Wildlife Reserve in Cameroon, the TRIDOM interzone, which overlaps Cameroon, Republic of Congo and Gabon and in Dzanga Sangha Dense Forest Special Reserve in CAR where WWF is seeking FPP's assistance to help the Reserve comply with the WWF/IUCN Principles and Guidelines for conservation projects and indigenous peoples (Woodburne, 2009). New work is expanding into DRC (Equator Province) to support indigenous communities facing a forest zoning plan that will decide the fate of huge areas of forest, dividing them into zones for logging, agri-business and oil prospecting, and much larger areas for conversion to oil palm plantations.

FPP state that their activities have stimulated increased debate among donors and conservation agencies about the impacts of conservation on local communities in Central Africa and that they will continue to work with communities and conservation agencies to develop approaches that enable hunter-gatherer communities to protect their forest rights as well as conserving the great ape populations.

FPP's focus is on developing models that provide practical solutions to accommodate the needs of forest people with those of wildlife and conservation organisations. While this has yet to demonstrate effective implementation on the ground in the Central Africa, it has gone some way to establishing an acceptance amongst certain conservation organisations that hunter-gatherer lifestyles have existed in conjunction with great apes for millennia—since so many of the places where we find high concentrations of great apes are those area most cherished and used by hunter-gatherers. This case-by-case engagement style of FPP contrasts in interesting ways with the approach adopted by Rainforest Foundation.

RAINFOREST FOUNDATION'S APPROACH TO MAPPING: A NATIONAL STRATEGY[7]

Beginning in 2001 the UK-based Rainforest Foundation established another project in Cameroon with CED to secure greater official recognition of the Baka's basic legal rights by focussing on civil and land rights. This was done with Baka communities living around Djoum and Lomie in south-eastern Cameroon who were assisted to obtain official documentation such as birth certificates and national identity cards. Rainforest Foundation's approach included promoting the wider recognition of the Baka's civil status in conjunction with community mapping as a strategy for Baka to gain enhanced legal rights over their land.

In Djoum, the project trained Baka from ten communities to map their local forests, enabling them to demonstrate how forest they depend on for hunting, fishing and farming has been attributed to logging companies who have been given exclusive rights by the national government to exploit resources in these areas. The methodology used by Rainforest Foundation and CED is similar to that used by CED in projects with FPP:

1. Make PRA village sketch map in community
2. Community designates mappers to collect GPS points in forest
3. Visit sites and geo-reference them using GPS assisted by project staff
4. Produce maps (mostly done back in the capital)
5. Return to village with maps for correction, review and validation
6. Restitution—laminated print-outs of validated maps are given to the communities that made them
7. Dialogue—the maps are presented to the authorities to establish a dialogue that seeks resolution to the problems identified in the maps.

While this process enabled many Baka communities to start to map their customary resources and show how their rights had been ignored in the national forest zoning work, the current legal situation prevented a formal recognition of Baka land rights since the new forestry law stated that their lands were now for the exclusive use of logging companies or conservation organisations. This prompted Rainforest Foundation to commission further research on customary land rights in Central Africa.

Two notable research papers, Hoare 2006 and 2007, emerged from this initiative and enabled Rainforest Foundation to develop its legal support for the mapping more effectively. The research showed that the pattern of land rights in the Congo Basin is a complex mosaic, often including overlapping rights to the same areas of forest and resources. Such a pattern reflects the fact that land and resource rights are often not exclusively held, and sharing of resources within and between communities is either tolerated or fully sanctioned. Bantu and Pygmy peoples often have parallel but quite different systems of land tenure and resource rights over the same forest areas.

In effect, traditional tenure and resource rights were often the result of

negotiation between different groups, and as a result they showed some degree of flexibility and adaptability. However, with the imposition of forestry reforms the situation is changing and land management policies in many parts of the region have tended to grant exclusive use rights to outside parties for extensive areas of forested land, overriding the prior tenure arrangements of local people. By seeking to fix forest usage through zoning the forestry reforms have tended to have a major negative impact on local people.

Since land-use planning on this scale requires determining the land 'needs' of different stake-holders, but is organised by government bureaucrats, local peoples' needs have been subjugated to those of governments and powerful outsiders. Without consultation, judgements were made about people's resource-use practices and ways of life that were economically and politically motivated. Typically, zoning projects prioritise conservation and industrial needs, with the allocation of large areas to national parks and logging concessions, rather than recognising local peoples' land rights and their resource needs for customary practices such as hunting and gathering.

A fundamental problem with the model applied to land-use planning in the region is that they assume that the best way to manage a forest is through allocating specific areas to different functions. While this model might be appropriate for the largely uninhabited forests of Europe or America, such a strict separation between different areas conflicts with the reality of land-use or land claims in the Congo Basin.

Alison Hoare's research concluded that there is a need to develop joint management regimes, which recognise multiple and overlapping use rights. This implies that existing local systems and structures of land management should be built on and adapted where necessary, rather than either being ignored, or at best, considered at the end of the process. This, Hoare argued, would entail intensive community consultation, to map local tenure and management systems, followed by lengthy negotiations between the various parties. This would require a long-term, ongoing, process of negotiation and monitoring (Hoare, 2007: 4).

These recommendations were formative for more recent work by Rainforest Foundation and its partners as it developed mapping activities across the region. This work seeks to equip and train civil society organisations and forest communities to produce accurate, geo-referenced maps and to use these maps to press for recognition of their rights to use resources and to protect their traditional forest areas from expropriation.

This led to a significant expansion of mapping work to RC, DRC, CAR and Gabon in conjunction with accompanying legal activities. These activities seek to promote legal recognition through supporting communities to take advantage of existing rights—from identity cards, to primary education—and by promoting national legal reforms to take into account indigenous peoples' rights. In particular Rainforest Foundation has been promoting the adoption of national legal frameworks setting out indigenous peoples' rights through supporting national law ministry staff in collaboration with civil society to prepare law propositions for submission to national law-making institutions.

The first of these law projects began in 2005 in RC with Rainforest

Foundation supporting extensive research among the different Pygmy groups of the country to develop a law proposition tailored to their needs. After a long and slow journey through the relevant administrative bodies, in late December 2010 the law was adopted by the Senate of RC. This makes RC the first country in Africa to provide specific legal protection to indigenous peoples. A similar process is underway in CAR. In Gabon and DRC Rainforest Foundation's legal work seeks to ensure indigenous peoples' rights and concerns are taken into account in the elaboration of new forestry laws relating to logging concessions and protected areas.

In DRC the government is in the process of preparing a national forest zoning plan, which will show which areas of forest will be protected in the future, which exploited, and areas that are likely to be cleared. Since 2006 the Rainforest Foundation has been working with the Congolese Natural Resources Network, (RRN) to carry out community-based mapping in all ten of DRC's forested provinces. By 2009 twelve mapping laboratories had been equipped and had produced 28 maps validated by the communities they represent. 146 mapping facilitators and 21 GIS technicians had been trained, and 528 men and women from both Bantu and Pygmy communities were trained as local mappers.

Rainforest Foundation invested heavily in an intensive and large-scale mapping process in the territory of Inongo, in Bandundu province. Maps produced by communities there have shown that their traditional areas often overlap with protected areas or areas attributed to loggers for large scale exploitation. Rainforest Foundation and its partners have sought to use the results from this to influence ongoing policy and legislative processes by channelling information to the officials and organisations concerned so that community voices and perspectives are included in legislation, policy and planning, and in particular in the new national forest zoning plan.

Rainforest Foundation has expanded the use of this model since 2009 in work in Gabon, CAR and RC. To promote better understanding Rainforest Foundation now work in projects that involve members of the local administration and Forest Ministry staff alongside local NGOs and local communities. In each of the countries Rainforest Foundation is equipping mapping laboratories and training staff and an extensive network of community mapping facilitators. The maps and other data produced by this network will be used as a basis for communities to plan and negotiate with local eco-system managers. They will also feed into local, national and regional planning processes, informing technical and policy discussions about land use planning and mechanisms for preventing and monitoring deforestation. Rainforest Foundation also provides legal training for communities and the NGOs that support them, to enable them to engage in processes of developing and implementing legislation that affects their land rights.

NGOS MAPPING AND ADVOCACY

FPP and Rainforest Foundation both use mapping, but within different frameworks: FPP promotes a localised, issues-based approach to addressing problems faced by Pygmy communities. Here the GPS is used as a means to create documents that provide evidence of the specific problems of a community for use in follow-up negotiations with specific ecosystem managers who have some measure of responsibility for the issues identified—so far mostly the relevant government and park authorities. Rainforest Foundation, although of course operating at the local level too, has a more nationally-orientated approach that involves large scale mapping and interventions at the national legal level and international level.

These different approaches complement each other, and together have provided an opening for the rights of hunter-gatherers to start to be taken into account in the Congo Basin. While these are promising beginnings the problems are huge and many are intractable. Much further work is required at all levels if hunter-gatherers are to have a real future in the Congo Basin. The stakes are high for the hunter-gatherers: if the situation does not improve it seems likely that they will lose access to good forest in all but a few areas, making their traditional economy inadequate at satisfying their needs and leading to increasingly unsustainable activities, sedentarisation and marginalisation.

While both FPP and Rainforest Foundation have made important achievements by means of mapping there remain fundamental issues to address. Mapping has not translated into secure land rights for Pygmy hunter-gatherers anywhere in the region. While the focus has been on resources, no-one is systematically mapping boundaries. While this is sensible since it often leads to disputes, the pioneering work of Planet Survey in the Bipindi Pipeline zone that successfully negotiated equitable land rights for all communities has not been replicated or attempted in other areas. Over-zealous claims that mapping is leading to the official recognition of hunter-gatherers' land rights are premature.

Governments are not reacting officially to land mapping, except maybe to ignore it. As an advocacy tool it has been more successful when presented to Euro-American organisations (conservationists) and companies (loggers), rather than local ones. Maybe with increasing pressure on governments in the region to begin recognising forest peoples' land claims as part of the legal superstructure necessary for an effective Reducing Emissions from Deforestation and Forest Degradation (REDD) or REDD+[8] mechanism to begin operating in their country, the substantial data on land use collected by the NGO community may become a key resource for determining land rights together with communities and ensuring that government planners are realistic in their decisions. Since the data was not collected in the context of land claims it may in fact have greater weight because it cannot so easily be accused of opportunism to enlarge claims.

What the outcome of this intensive mapping will be remains to be seen. If we look at examples from other parts of Africa, sadly it is not encouraging for hunter-gatherers' rights. For instance, the recent case of the Bushmen in Botswana's Kalahari Game Reserve shows that even where land rights have

been recognized for decades they are vulnerable to be arbitrarily withdrawn if governments decide so. Clearly this is an ongoing issue that will require committed long-term engagement by many parties if it is to result in lasting solutions.

MAPPING IN THE LOGGING INDUSTRY

The introduction of logging in the Congo Basin is usually associated with road construction, labour immigration and the development of substantial local infrastructure (towns, saw-mills etc). Routinely this leads to the emergence of commercial bushmeat trading networks to supply local demand. These almost inevitably become linked to urban markets, resulting in the establishment of networks dominated by traders and professional hunters, often controlled by powerful national elites. International conservation organisations react to these very real threats to wildlife by imposing militaristic wildlife protection regimes as a crisis management tool. These combined developments are having profound negative consequences on Pygmy peoples' access to forest and forest resources.

The colossal power differences between industrial logging companies and forest communities means that forest peoples' concerns are of little consequence for industrialists' decisions concerning the use of forest resources. Logging companies generally obtain rights over forest resources through permission from central government without any need to consult or otherwise involve local forest people in the management of the areas they both occupy. Unless the company is seeking an internationally recognised certificate of sustainable forestry, such as the Forest Stewardship Council certificate, it is not under any obligation to include local forest communities in key decisions that impact on their livelihoods or resources.

The Forest Stewardship Council (FSC) scheme is one of an array of certification schemes that promotes responsible management of the world's forests by defining international standards for environmentally appropriate, socially beneficial and economically viable stewardship. FSC inspections and audits are carried out by certifying bodies that are supposed to be independent, but who are paid for their services by the logging companies that they audit.

One company operating in northern RC, *Congolaise Industrielle des Bois* (CIB), pioneered the development of mapping procedures to ensure that Pygmy and other forest peoples' rights to their land and forests were documented and respected during its logging operations in accordance with Principle 3 of the FSC principles and criteria. As of October 2010 all its active concessions were FSC certified, covering some 1,300,000 hectares in the Sangha Region of RC.

Supported by the Tropical Forest Trust (TFT), FPP, and this author, CIB pioneered the use of mapping in addressing the FSC principles concerning respect of the rights and resources of forest and indigenous peoples living in the forestry concession (Principles 2 & 3). The procedures we developed to do this at CIB have become a model that has been emulated to different extents in every other FSC certified concession in the Congo Basin.

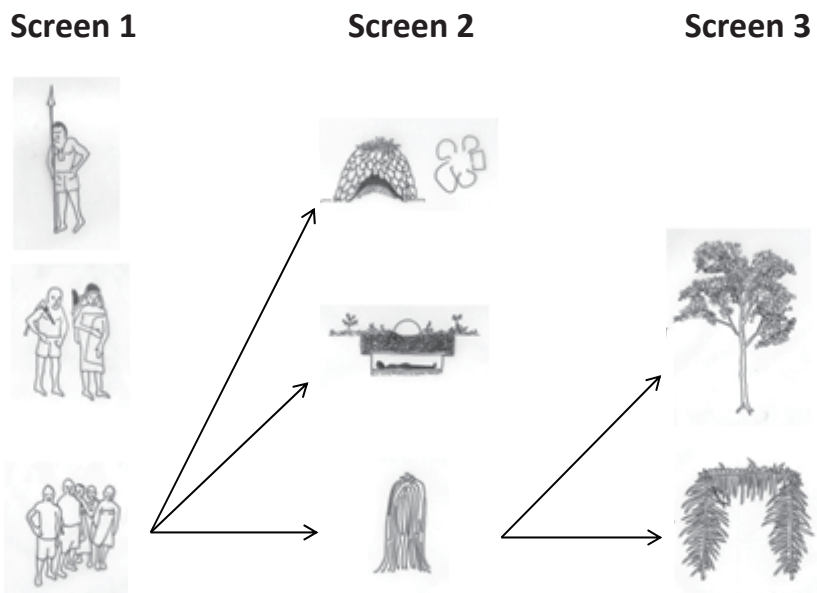

Fig. 1. Iconic decision-tree showing the pathway for geo-referencing a sacred place.

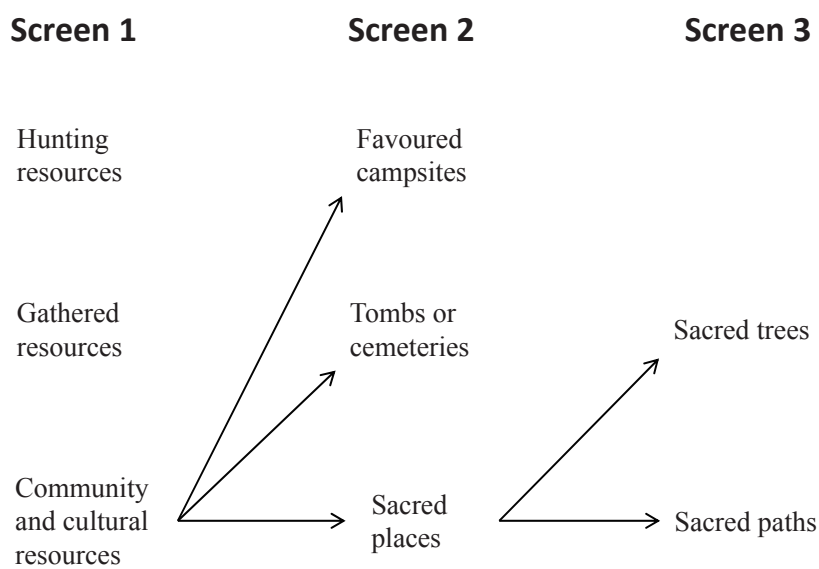

Fig. 2. Decision-tree showing the pathway for geo-referencing a sacred place.

Guided by the Mbendjele Pygmies living in the area, with technical support from Helveta Ltd, a software company in the UK, the project developed mapping tools for non-literate people by designing iconic software to operate on a ruggidised hand-held computer attached to a high performance GPS unit. The combination of intuitive iconic software and automated GPS recording processes allowed non-literate people to quickly and accurately map their key resources prior to logging in their traditional forest areas. This has successfully ensured that their resources are not damaged or removed without their free, prior and informed consent (Hopkin, 2007; Lewis, forthcoming).

The software for the Mbendjele was designed by my wife, Ingrid, and I using our knowledge of how Mbendjele divide up activities and what they had told me about the resources they were concerned to protect. So the home page has five icons: a man with a spear (hunting areas); a couple with axe and basket (gathered resources); a group of people (social and religious resources); a fish (fishing places) and a farm. Pressing on one of these icons leads to a new screen with icons depicting characteristic actions or sights associated with a particular resource. Our years living in the forest meant that we were sure the icons would be obvious to the Mbendjele. If the software was to work it had to have an intuitive logic for forest people.

This has proved true. Within ten minutes almost anyone can start using the handheld device, and within half an hour a sensible person is fully competent. The only difficulties encountered were among some older people with poor eyesight who had difficulty seeing the icons on the small screen. Younger people would quickly come to their help showing them what to press. During mapping with such elders, the youth would manipulate the handheld device and so learnt from the elders about resources and areas they may not have previously known.

In the example illustrated above, a woman wishing to protect a sacred tree walks to the tree and presses the touch screen icon of people grouped together on the home page. This takes her to screen two showing three community and cultural resource items that people were concerned to protect. She chooses ‘sacred places’ by pressing on the icon of *Ejengi*, an important forest spirit. This takes her to the third screen where she can choose between the sacred path and the sacred tree. She presses on the icon of the sacred tree and the GPS unit makes a ‘beep’ to inform her that the point has been saved to the hard-drive.

Importantly the new system overcame a number of key problems associated with human error and efficiency. Data was automatically registered with location and type of resource on the hard-drive and could be transferred by blue-tooth or cable to a suitably configured laptop, even deep in the forest, in less than a minute without any mistakes. First visualizations were on Google Earth; now better quality satellite images are used. These are much easier for people to understand than pixilated images or the abstract flat colours symbolizing different vegetation types or geographic features on previous maps.

Now the quality of the mapping could be checked as mapping progressed. If all the points were on a straight line then clearly people were not properly covering the territory but simply walking along a path and pressing icons

from time-to-time. The maps could be discussed with the community mappers, elements could be questioned—why is nothing recorded here, why so many resources here, and so on? In this way participants understand better the point of what they do and become increasingly confident at interpreting the maps by understanding more of the process by which the resources they were identifying were turned into pictures on a piece of paper. Once all the resources that people wanted protected have been geo-referenced their locations are integrated into the maps showing the planned cutting schedule.

MAPS DO THE TALKING

Rather than Mbendjele being taken into the intimidating atmosphere of the management offices, the maps would go there for them. Company staff would translate the icon maps into Arcview files that were compatible with the GIS software they used to organise forest exploitation. They could compare the resources that Mbendjele wanted to protect with those they had planned to cut down. Wherever there was a conjunction of a resource they wanted to cut and one the people wanted to protect, the resource was taken out of the cutting schedule. In theory, if the company felt that they had to remove a resource that people wanted to keep they could begin negotiations at this stage. In fact this has not been necessary. Every resource that the Mbendjele wish to protect has been removed from the cutting schedule and marked with white or pink paint to alert forestry workers.

The community-owned maps produced in this process are a new language by which communities can make their concerns known to company managers far more effectively and efficiently than if this was attempted through dialogue. The maps enable company managers to efficiently and systematically incorporate local forest peoples' concerns into their forest management planning and identify any potential areas of conflict for follow-up negotiation and discussion.

Where differences in power, culture and language make face-to-face communication difficult, vulnerable to misunderstanding and often ineffective, this technology enables both parties' concerns to be considered equally. CIB can now prove that they are respecting the key resources indigenous peoples have indicated to them, and that they are taking the necessary steps to demarcate and protect them from damage during harvesting. In the case of disputes, CIB are bound to a conflict resolution mechanism acceptable to all parties. Outside NGOs monitor this mechanism seeking to ensure that conflicts are resolved fairly.

But there still remains a lot to do. Only a handful of logging companies are FSC-certified in the Congo Basin and nowhere in the tropics has the promise of FSC been fully achieved. The problems are many and complex; from corrupt institutions, illegal logging, and auditors with different standards for judging compliance, to companies continuing to ignore indigenous peoples in non-existent, poorly designed or implemented social programmes.

What is significant is that participatory mapping with indigenous peoples is

now standard practice amongst logging companies seeking certification across the Congo Basin. In effect, the rights of indigenous peoples to their land and resources are gaining de facto acceptance, despite most states' dismissal of them.

The validity of an FSC certificate as a means to ensure that a forest is sustainably harvested and responsibly managed is currently being undermined. Some companies, and their FSC certifiers, appear to be cutting corners in order to secure certificates as fast as possible in order to gain access and a market share of high value markets in Europe and elsewhere. The result is a slow slide towards process indicators (e.g., *they are on the right track*) rather than achievement of the standard as expressed in the FSC Principles. This inevitably results in the acceptance by certifiers of a lower standard of proof. The result is what some regard as non-credible FSC audit processes resulting in questionable certificates being issued[9].

Additionally, the participatory mapping approaches described here are vulnerable to being abused by elites to give their executive decisions some appearance of popular legitimacy. Over time I have observed the system we implemented in CIB being steadily undermined, and copy-cat systems in other logging companies 'stream-line' the procedure so that people would never be consulted to determine which resources they felt required some measure of protection, nor were they active data gatherers. Rather they would participate in identifying the resources the company felt it could protect and company workers would effectively data-mine for the minimum information required to satisfy the auditors. Local people have no say in what sites were protected and which ones not, and they are unable to monitor to what extent the company respects its obligations towards them and their resources.

Several companies wrongly claim that this type of participatory mapping is all that is needed to obtain the free, prior and informed consent of local people to their operations. In no case has any logging company made reasonable efforts to communicate effectively both the positive and negative possible consequences of logging to forest people before logging begins, nor have they offered forest people the opportunity to say no to industrial operations on their land. So although protecting forest peoples' resources is a positive step, it is used to legitimate activities rather than build effective co-management relationships and information exchange that any genuine FPIC process must be based upon (Lewis et al., 2008).

THE EYES AND EARS OF THE FOREST: DIRECTIONS OF CHANGE

I. Monitoring Illegal Logging in Cameroon

The success of the mapping project in Congo with the Mbendjele and CIB spawned other projects in different parts of West and Central Africa. In Central African Republic and Cameroon the technology is now used by FPP to show that hunter-gatherers require access to their customary forest recently

encompassed by protected areas, in Nigeria to track rare primates and other fauna in a national park, and in Cameroon to monitor logging.

The Cameroon project reveals some of the directions of change and though I can describe it only briefly here, Lewis 2007 provides more detail. The forests of Cameroon are subject to extensive legal and illegal logging. Many communities, including Baka Pygmies, are losing important trees, such as moabi[10] and sapelli[11], which they depend on for fruit, caterpillars, medicines and oils, and for modest incomes generated by selling these products on local markets. In addition to industrial loggers, artisan[12] loggers make incursions into community forest where they fell trees that are vital to the poorest peoples' subsistence. Until now, local communities have had little support in facing up to these serious threats to their livelihoods. They, like the Cameroonian government, the European Union and others, want this to stop.

As part of an effort to improve forest governance, the Cameroonian and British governments[13] supported a redeployment of the system developed in Congo. The objective of the project was to enable local forest people to monitor logging activities in their forest areas regardless of their education or language, and so contribute an independent means of verifying the enforcement of forestry law. Locally collected data on logging activities is periodically uploaded to a secure website via satellite link. Project partners[14], including Cameroonian forest law enforcement agencies and local NGO partners, can access the website to gain up-to-date information to monitor and control logging activities. In addition to increasing the government's forest monitoring capacity the website creates a new platform for building a dialogue between government, NGOs and communities about forest management. It also provides an accessible platform to audit, and demonstrate governmental commitment to good governance.

In south-eastern Cameroon I did not have the same intimacy with local practices in the forest as I did in Congo, so I could not rely on my own knowledge to develop appropriate icons. To ensure that the software would be as intuitive and self-evident to the new users as it was for Mbendjele in Congo I configured a prototype iconic decision tree and took it out to forest communities for testing, accompanied by a software engineer from Helveta and local NGO partners. The new configuration included most of what had been used in Congo but added a section for monitoring logging.

Once encamped in the first small village on our circuit in south-eastern Cameroon we presented the icons one-by one to the assembled villagers. Rather than telling them what each icon meant we asked them to tell us. Performing this test in several different ethnic areas allowed us to check that the icons were intuitively obvious across language groups. During each session problems were noted for modification later. Once people understood how to use the software and computer, we formed working groups to take the handhelds into the forest around the village. Depending on the ethnic mix of the village we would compose groups to reflect this. There was always one group of women.

As people tested the software they pointed out problems; things they wanted that were not there, icons that were unclear or could be improved and so on. All this was noted. On return to the village the software engineer, Simon

Bates, and I would spend a few hours drawing new icons surrounded by local commentators, and update the software in order to reflect the comments and changes desired by the community. This enabled us to test the new icons and decision tree the following day in the next community.

This method of participative software development was very successful. As a result of this iterative development the icons for monitoring logging became more and more tuned to local realities. A tree stump on the front page led to further screens that allowed the user to geo-reference felled trees, abandoned logs, trees marked for future felling, to record the diameter of the tree or log using colour-coded lengths of string and even indicate if the logging was conducted by an industrial logger (bulldozer tracks) or by an artisan logger (abandoned planks). By the third community visit people no longer requested changes. We were now confident that the software could be deployed among users speaking a range of different languages.

The system is just beginning to be deployed in south-eastern Cameroon and each community is first asked for their free, prior and informed consent before participating. Since identifying illegal activity carries potential risks it is important that local communities understand this, and also the safeguards in place to address these risks.

1. Ask community if illegal logging is a problem for them
2. Explain how this could be described through the collection of geo-spatial data
3. Discuss potential risks and benefits of beginning to collect and disseminate scientifically valid data concerning the issues identified
4. Once issues are understood either
   - 4.1. Satisfactory protections (e.g. privacy levels, NGO support) are discussed and agreed upon to limit the potential for harm, or
   - 4.2. Consent is withdrawn by the community and the process ends. Participants have the right to withdraw consent at any point in the project and if they ask, the data they collected will be deleted[15].
5. Community gives its free, prior and informed consent to participate in the activities.
6. Community designates mappers to collect GPS points in forest
7. Visit sites and geo-reference them using GPS, assisted if needed by project staff
8. Produce maps on site and discuss mapping process
9. Review maps for correction and validation
10. Restitution—laminated print-outs of validated maps are given to the communities that made them
11. Dialogue—with support from local NGOs, the maps are presented to the authorities to establish a dialogue that seeks resolution to the problems identified in the maps.

This project has developed further the potential of Pygmy mapping using GPS units by demonstrating the value and effectiveness of community monitoring.

This could lead to support for communities to become key players in the emerging environmental services and carbon trading markets by enabling them to provide high quality environmental monitoring. If successfully developed this holds promise for finding an active role for Pygmy groups and other forest people to act as monitors of new schemes such as REDD or Payments for Environmental Services (PES). Unless local forest people have some opportunity to play a role in these emerging economies they will simply be bypassed and yet more of what they consider to be their heritage and birth right will be denied them, and the benefits enjoyed by others elsewhere.

II. Where Next?

As new problems are identified appropriate software builds can provide local people with the means to monitor the issues and establish relationships with eco-system mangers to address the problems. The success of the Mbendjele project with CIB in Congo has resulted in the Mbendjele requesting a new software build for the handhelds used for resource mapping by the logging company.

Mbendjele are very concerned about over-hunting by commercial poachers. This is also a major preoccupation of conservationists and the logging company, but they have never found an effective way to capitalize on the Mbendjele's knowledge of poachers' whereabouts to control them more effectively. In response to this request and in consultation with Mbendjele and Wildlife Conservation Society who manage the anti-poaching patrols, we are developing a new set of software specifically for recording evidence of poachers' activities.

To facilitate this kind of redeployment a major project is beginning at UCL[16] to develop tools and technological platforms to support any community regardless of literacy or educational background to participate in scientifically valid data collection. We are calling this 'extreme citizen science' or 'ExCiteS' for short. ExCiteS has transformative potential in our efforts to deal with major sustainability challenges by making scientifically valid data sets available to a wide range of users in formats that are accessible to all of them—even if they are not literate. The tools we develop will help communities to understand their environment, to analyse it as it changes, and potentially to participate in international schemes as monitors, or increase their food production or better cope with environmental change, by using scientific modelling, predictive software and improved management methods.

ExCiteS will build on the principals of Citizen Science and participatory monitoring to make it accessible regardless of educational levels to any community so that they can:

1. frame their environmental problems in their own terms
2. be supported to elaborate scientifically valid data collection protocols to provide evidence of the problems identified in 1
3. present the results in formats that all key participants, including eco-system managers, can 'read'

4. facilitate informed decision making by all concerned parties based on addressing the problems or trends identified
5. continue to monitor in real-time the efficacy of actions or interventions taken to address the problems identified

By creating tools that enable forest people to monitor their environment in ways that are useful to different interested parties, it becomes more likely that forest peoples' concerns are taken into account by national and international decision makers. By using models based on local ways of categorising the environment these tools will also facilitate a broader understanding by forest people of the changes increasingly affecting their forest regions. By visualizing the impact of changes in their traditional areas in new ways, forest people will educate themselves, and us, in how their ecosystem is changing and hopefully stimulate us all to think about why and what to do about it.

CONCLUSION: WHY MAPS?

Many Pygmy groups are becoming increasingly aware of the power of maps. They have witnessed how government officials refer to the authority of maps when explaining that they no longer have access to conservation areas in their territories; or how the loggers use them to mark the trees they will exploit; and how those who have community forests use them to demarcate these areas. Increasingly people perceive of the process of recording their forest resources on a map as a means of claiming them.

The maps they are producing are enabling them to make their presence visible, to promote their visions of value and ensure that their concerns are given proper consideration in forest management decisions. This is important since without more promotion of forest peoples' interests major land management decisions are being taken by powerful outsiders that have profoundly negative implications on Pygmies' ability to continue living as hunter-gatherers as they are steadily disenfranchised of their land and resources.

While the outcome of these technologies is a greater voice for forest people in forest management, it avoids overt political engagement. In the context of politics in the Congo Basin, which often focus on competition between bigmen for control of resources, this maintains vital political neutrality and an anonymity that is greatly valued by hunter-gatherers.

In all the cases described we have found maps to be the most effective way of translating the data collected by communities into formats that they and key decision makers can quickly 'read' and understand, and to my initial surprise, has resulted in the rapid integration of local concerns into management practices in ways that seek to avoid or address the problems identified. It seems that maps' potential for representing complex information graphically is as attractive to time-constrained decision-makers as it is to the non-literate participants in these projects. Maps are simply easier to read than text and thus more accessible to people with different linguistic and educational backgrounds.

Indeed maps predate text as a form of human communication by many thousands of years, and this may partly explain their effectiveness in this respect. The oldest map found in Europe was discovered in Pavlov in the Czech Republic (Klíma, 1991). It depicts a mountain, river valley and routes around the region and is about 25,000 years old. More recently (Utrilla et al., 2009) have found etched stones in northern Spain that they argue represent maps from 14,000 years ago. The earliest writing emerged only 6,000 years ago. This suggests that maps and representations of spatial information can be expected to be more accessible to more people regardless of their literacy. This has important untapped implications for the many non-literate indigenous people who are frequently the main 'gate-keepers' and stewards of key environments for world climate stability and biodiversity—such as the Pygmy hunter-gatherers discussed here.

NOTES

(1) This paper was originally given at an international symposium held in honour of Professor Ichikawa at the Centre for African Area Studies, Kyoto University on March 13th 2010.
(2) In this paper I describe this from the point of view of Pygmies rather than their villager neighbours who are affected by many of the same forces. These farming and fishing communities make limited use of the forest by comparison to Pygmies and depend on smaller areas. While they are also documenting their land use using GPS units the problems they face and the context are different and beyond the scope of this paper to discuss.
(3) Farmers villages tend to be marked on maps and their fields and other clearings of forest cover are visible in aerial and satellite imagery. This is rarely so for Pygmies' land-use.
(4) http://cmsdata.iucn.org/downloads/durbanactionen.pdf (Accessed on 31May, 2011)
(5) This section is based on information from Forest Peoples Programme (2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2006b) and Rainforest Foundation UK (2001, 2003, 2005).
(6) This section draws on Forest Peoples Programme (2003, 2004a, 2004b, 2005a, 2005b, 2006a, 2006b, 2007a, 2007b, 2008, 2009).
(7) This section is based on information from Rainforest Foundation UK (2001, 2003, 2005, 2006−7, 2008−9).
(8) REDD+ mechanisms put much greater emphasis on social equity as part of sustainable forest management.
(9) Letter to FSC November 2006 from Friends of the Earth Cameroon, Netherlands, and France; the Centre for Environment and Development, Cameroon; the Forest Peoples Programme, UK, and Greenpeace International.
(10) Baionella toxisperma.
(11) Entandrophragma cylindricum.
(12) Groups of men with chain-saws and frames which they use to cut planks directly where the tree falls. The planks are then carried individually out of the forest to roadsides for transport and sale.
(13) Funded by the British Commonwealth and Foreign Office.
(14) The project team includes FPP, CED, a software company (Helveta) and members of

the Anthropology Department at University College London (UCL).

(15) To the extent possible, since print outs that contain that data may be in circulation. Although these maps accurately indicate places they do not provide coordinates.

(16) Extreme Citizen Science project is funded by the Engineering and Physical Science Research Council of UK for the period 2011−2016.

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